Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

NEW DISCOVERIES OF FOSSIL MAMMALIA OF SOUTHERN PATAGONIA.

BY FLORENTINO AMEGHINO.[1]

I.

At this time, the most important discovery in South American paleontology is the presence of true monkeys in the Eocene of Patagonia. Certain paleontologists have expressed doubts as to the age of the remains. I believe that these doubts have no foundation from whatever point of view one approaches the subject.

From the geological standpoint, the latest researches of my brother, Carlos Ameghino, show that the marine formation, which I have named *Subpatagonian*, and the formation of sub-aerial or terrestrial origin that I have designated *Santacruzian* (the formation which contains the mammals in question), are conformable without a break. The characteristic fossil of Subpatagonian formation is *Ostrea bourgeoisii* (R. de C.). In the east, toward the Atlantic, the lower part of the Santacruzian formation, is found to be intersected with beds of *Ostrea bourgeoisii*, representing the upper part of the Subpatagonian with all the beds of the two formations resting upon each other conformably. In the west, toward the Andes, in the lower reaches of the Rio Sehuen, and in the vicinity of the lakes Viedrua and Saint-Martin, the marine beds of the Subpatagonian formation rest on the Dinosaurian beds of terrestrial origin, contemporary with the North American Laramie (Pehuenche formation); the transition from one formation to the other is almost imperceptible. Throughout this region no mammalian remains have been found in any formation more recent than the Santacruzian. It is then certain that the fossil monkeys belong to this formation. The *Homunculus* specimens have always been found in place, and in the lower Santacruzian beds. It is beyond a doubt that the fossil monkeys belong to the Santacruzian fauna.

---

[1] From the Revue Scientifique, Jan. 7, 1893.

It remains now to ascertain if the Santacruzian fauna is really Eocene, or if it belongs to a more recent epoch. The affinities of the lower part of this formation with the Dinosaur beds, the presence of Creodonts and Plagiaulacidae, the absence of the modern groups of Ungulates, seem to me to demonstrate plainly that we have to do here with a fauna which dates at least from the commencement of the Tertiary epoch, and which represents the development upon the spot of an autochthonic fauna dating from an anterior geological epoch. Another proof of its antiquity is that a large number of Laramie mammals from the United States described by Marsh, have their nearest allies in the Eocene of Patagonia.

On the other hand, some of the forms characteristic of the Puerco fauna of North America are found in beds much more recent (Lower Oligocene and Upper Eocene) of the Argentine Republic in the neighborhood of Paranà (*Periptychus* Cope). It must also be said that all the authors who have studied the conchological fauna of the rocks of Paranà (d'Orbigny, Darwin, Bravard, Doering, Philippi, etc.), have referred this fauna to the Upper Eocene or to the Lower Oligocene. But, between the Santacruzian fauna and the fossil fauna of the Paranà, there is, when we consider the development of forms, a considerable hiatus, almost an abyss, that can only be filled by the aid of a half-dozen intermediate faunas yet to be discovered. Moreover, the greater part of the types of the Santacruzian fauna, considered from the point of view of an evolutionist, represent forms less advanced than do the totality of similar forms found in other continents.

Thus all the evidences—geological, paleontological and evolutional—are in favor of the great age of the Santacruzian fauna. I place this fauna at the beginning of the Tertiary, and consider it to be contemporary with the fauna of the Puerco of North America. I believe that the more we seek to place this fauna at a later date, the harder it will be to explain the affinities it presents with the faunas of other continents.

Returning now to the fossil monkeys of this formation, I can say that my brother, in his last exploration, found some new specimens, among them, a skeleton, almost complete, of *Ho-*

munculus patagonicus, in the lowest bed of the Santacruzian formation. This skeleton is imbedded in a large block of stone, and, as yet, only a few bones have been exposed. The lower jaw has been taken out almost intact, with its entire dentition. This new specimen, the preservation of which leaves nothing to be desired, shows that the jaw is not so narrow nor so compressed as I have figured recently in drawing from a specimen whose symphysis was evidently distorted by pressure. In the new specimen now at hand, the distance between the internal posterior border and the second true molar on each side is 10 mm., 5. It thus results that the two dental series are more widely separated at the back, and that the whole jaw is much more elevated.

The exact dental formula is I $\frac{2}{2}$, C $\frac{1}{1}$, P M. $\frac{3}{3}$, M $\frac{3}{3}$. The first two true inferior molars are very nearly of the same size, but the third is smaller. The internal incisors are weaker than the external ones. The canine is a little more developed than in the first specimen, and is separated from the premolar by a small diastema. It is probable that the two specimens are respectively male and female. Unfortunately, the individual represented by the new specimen, was very old, so that one can no longer detect the details of the surface of the crown of the molars. The dental series measure, in a straight line, 31 millimeters. The femur is 11 centimeters, and the radius 95 millimeters long. The humerus has a large epitrochlear perforation, but it lacks the intercondylar foramen. Each of these bones, in form, are those of a man in miniature.

Among the other forms belonging to the Santacruzian formation, and which ought to be better known, I will select only the most important, beginning with the Ungulates which are exceedingly interesting.

II.

I have been able to reconstruct the foot of the Mesorhinidæ (the genera Mesorhinus, Theosodon, Pseudocoelosoma), which are the predecessors of the Macraucheniidæ. The genus Theosodon had five toes in front as well as behind; the three in the middle were well-developed, very similar to those of *Macrau-*

chenia, but the internal and external on each foot were very small.

The Homalodontheridæ also had five toes on each foot, but with them all the toes are well-developed. The feet are strong and robust, and it is worthy of note that the hoof-bearing phalanges are split up, and have the same shape as those of the Chalicotherium of Europe. The carpal and tarsal bones have the alternate arrangement. The legs are equally robust, and the humerus has an epitrochlear foramen. The bones of the feet and of the legs bear a singular resemblance to those of the Edentates, but there are also more characters of specialization altogether peculiar, without which they might be taken for the direct ancestors of the Edentates. The Homalodontheridæ are the ancestors of the more modern Chalicotheridæ of the Northern Hemisphere. It is a mistake to look for the stock of the Chalicotheridæ in the Meniscotheridæ. The latter represent a type allied to the Proterotheridæ, with which they ought to have a common ancestor as yet unknown.

The Proterotheridæ present us with peculiarities still more surprising. The discovery of the leg bones of the Thoatherium prove that it was a monodactyl like the horse. Moreover, in the *Thoatherium minusculum*, the reduction of the parts was still more advanced than in the horses; the posterior feet are very slender, provided with a single toe, the third, while the second and the fourth are represented only by vestiges of the metatarsals, much more atrophied than are the same bones in the horse. One sees, in this case, an example of parallel evolution very remarkable. A complete reduction of the bones of the foot among the ungulates has taken place in two different families, at two different epochs, a fact perhaps without precedent in the Vertebrate series.

It is, however, certain that there exists a certain ancestral relation between the Proterotheridæ and the Equidæ, for the latter have descended from a form approaching the Protere-therium, but with complete dentition. I have elsewhere stated that in Europe as in North America, one may be able to trace the genealogy of the horse beyond Anchitherium (Mesohippus included), and that one ought to separate definitely from the ancestral line of the horses, the genera Palaeotherium and Hyracotherium, as well as the different types of the sub-order of Condylarthra. In my opinion, the horses originate from a group of Litopterna, from which sprang, at the same time, the Paleotheriidæ and the Hyracotheriidæ, and this ancestral type would be closely related to the Proterotheriidæ.

It would seem that I am right, for the splendid monograph of the genus Mesohippus, recently published by M. Scott, shows that the calcaneum of this genus still possessed a very small articular facet for the fibula, the last vestige of the litoptern organization, however, the shape of the astragalus, as a whole, is already like that of a Perissodactyl.

We now have evidence to warrant the statement that the horses are descended from a form allied to the Proterotheridæ, and which ought to differ from it above all by its orbits open behind, and its complete dentition, in a continuous series. This ancestral is, perhaps, the *Notohippus* or a kindred genus, but, be that as it may, it is undoubtedly in the Northern Hemisphere that the group of horses has acquired the characters which distinguish it at the present time.

The genus *Astrapotherium* is now known, not only by a skull almost entire, but by many of the bones of the skeleton. The skull, in its anterior part, agrees in a number of points with those of the Proboscidians, and could have carried a proboscis as fully developed as that of the elephants. The bones of the limbs also greatly resemble those of the elephants, and there is no doubt that this type represents the nearest relative of the Proboscidians discovered up to this time in the older formations. The genus *Astrapotherium* is certainly not the direct ancestor of the Proboscidians, but only a collateral branch of the trunk from which the latter have sprung. However, some of the other genera of the family of the Astrapotheridæ, Astrapodon for example, may well be considered the ancestor of the living Proboscidians.

In any case, the latter have acquired their characters upon some other continent, as it is certain that during the epoch of the formation of the fossiliferous beds of the Paranà, the Proboscidians had no representatives in our country. These animals did not make their appearance in the Argentine Republic until the end of the Miocene.

The new specimens of fossil rodents taken from the Santacruzian formation afford unexpected opportunities for comparison. The fossil Cercolabinæ of Patagonia are the ancestors of all the hystricomorphous rodents. The Stiromys have, while young, five superior molars on each side, but the next to the last premolar is soon lost. From the primitive Cercolabinæ are derived the Eocardiinæ, the Eryomyinæ, and the Echinomyinæ. The Eocardiinæ, in their turn, have given rise to the Caviidæ and to the Dasyproctinæ. The Octodontidæ, which now seem to be isolated, have come from certain forms of primitive Echinomyinæ. The discovery of complete skulls of the genus Scieromys, enables me to recognize in this genus the true origin of the Octodontidæ. There are still some intermediate forms wanting, but, no doubt, they will be found soon in the fossiliferous formation of the Paranà.

Not only are the Cercolabinæ of the Eocene of Patagonia the primitive source of all the Hystricomorpha, but they are also the ancestors of another group of rodents, the Myomorpha, which seem also, for the present at least, entirely isolated in that order. The origin of the rats is found in the genera Acaremys and Sciamys, from the lower Eocene of Patagonia. The Myomorphs are not derived from the Acaramyinæ, they having lost their premolars and undergone various modifications in the conformation of the skull. If fossil rats have not yet been found in the Paranà beds, it is on account of their fragile bones, but, in all probability, they will be found there some day.

I now know a part of the dentition of the animal that I have named Tidaeus—this name being preoccupied, I substitute for it, Mannodon. The *Mannodon trisulcatus* is the first genus of Plagiaulacidæ of Patagonia which has the inferior molars constructed on the same type as those of the Multituberculata. It is a genus closely related to Neoplagiaulax and Ptilodus.

Many of the types of the Plagiaulacidæ present a feature that is strange to be found among mammals. The Epanorthidæ, for example, have the inferior incisors beveled on their *internal* border, and not on their upper face as is the case among rodents and all other known mammals which have chisel-like incisors the mandibular branches of the same animals have no symphyseal suture, the surface of the bone, at this point, being nearly as smooth as the rest of the jaw. It thus results that the two mandibular rami of the Epanorthidæ were susceptible of lateral movements, and the singular incisors could perform, up to a certain point, the function of horizontal pincers.

Also, although I am quite convinced that the Plagiaulacidæ and the allied fossil forms have been derived from the Didelphian Diprotodontia, the relation with the living Diprotodontia is not so close as I had thought. The discovery I made showing that the large furrowed tooth of the mandible of the Plagiaulacidæ is not the last premolar, as had been believed, but is the first true molar, separates the latter from the living Diprotodontidæ. This character justifies a sub-order in the Diprotodontia, to which can be given the name Plagiaulacoidea, a name which is as appropriate for the northern forms known as Multituberculata as it is for those of the Eocene of Patagonia.

The recent studies that I have made of the Microbiotheriidæ have confirmed me in my opinion that they represent the direct ancestors of the living Didelphyidæ. The latter have certainly originated in South America, and although their remains have not yet been found in the Paranà formations, they will be found there some day.

One of the fossil groups of Patagonia which presents the greatest interest is that of the primitive Carnivora, allied both to the Dasyuridæ and to the Creodonts. It seems to me impossible to find a line of demarcation between them. In studying the material in my possession, I arrive at the following conclusions: The Dasyuridæ are descended from the Microbiotheriidæ and are then modified into Creodonts; these, in their turn, are transformed into the more modern Carnivores. The dental formulæ of these primitive carnivora are varied—take, for example, the superior incisors, of which the Microbiotheridæ have five pairs like the Didelphydæ; the Dasyuridæ have only four pairs, and the same number is found among other forms allied at once to the Dasyuridæ and to the Creodonts. The larger number of the Creodonts have only three pairs, and, in some genera, but two, and even a single pair. There are some specimens in which one can trace the evolution from the primitive formula. Thus, in the genus Amphiproviverra, the internal pair of superior incisors are entirely atrophied and useless, while the other three pairs are well-developed. This proves that it is the internal pair of upper incisors that is lost in the passage from the Dasyurian form to the creodont and carnivorous forms.

Perhaps the most remarkable specimen discovered during the last exploration is a skull almost entire of *Borhyæna tuberata*, an animal which has hitherto been known only by some insignificant fragments. It is certainly one of the most singular carnivores that is known. It must have been rather large since its skull is 205 millimeters long, and nearly 15 centimeters in transverse diameter at the level of the zygomatic arches. The upper arch of the skull is in an almost horizontal plane with the cerebral cavity excessively reduced, but the sagittal crest is very long and well-developed; the frontals have no postorbital apophyses, and the nasals are widened behind in an extraordinary manner; the anterior nasal opening has the characteristic form of placental Carnivora. The lachrymal canals open entirely inside of the orbits. The malar bone is prolonged behind to the glenoid cavity, of whose border it forms a part of the boundary as in the Marsupials. The palate has no palatine foramina. The upper incisors are reduced to two pairs, of which the internal one is atrophied. Between the canine and the external incisor on each side, is a large groove intended to accommodate the lower canine; this groove replaces the deep fossa which is found in the same place in Dasyurus and Amphiproviverra. These grooves and the contraction of the anterior part of the intermaxillary bone, followed by the reduction in the number of the incisors, gives the anterior part of the skull the appearance of a rodent. The canines, premolars, and molars, of each side, form a continuous series. There are seven molars, of which three are premolars and four are back molars. The first have but a single cusp, but they have a posterior heel, well-developed in the last. The first three true molars increase regularly in size from the first to the third, and have the anterior internal cusp atrophied, which gives them a cutting form, especially noticeable in in the third. The fourth is much reduced, and occupies the same position as in the genera Thylacynus, Prothylacynus and Amphiproviverra. Perhaps Dynamictis, of which only the lower jaw is known, is a synonym for Borhyæna. In any case, the latter animal was a formidable Carnivore, as dangerous as our tigers, and which it is hard to classify. It may belong with the placental Carnivores, or among the marsupial flesh-eaters (Dasyures), or with the ambiguous forms known as Creodonts.

It would take too long to speak of the numerous fossil Edentates of the Santacruzian formation and of the many peculiarities they present. However, I cannot resist mentioning one of the greatest novelties of the new family of the Metopotheriidæ, which comprises the genera Metopotherium, Pelecyodon, and Zamicrus. In this group, each of the horizontal branches of the mandibula is formed of two distinct bony parts, one in front, the other behind. These two pieces are united by a suture which commences at the alveolar border, very nearly in the middle of the dental series, and is directed obliquely back and down, terminating in the lower border, almost just below the last tooth. This is evidently a character inherited from the reptiles. The same suture can be seen, but not quite so plainly, in the mandible of some of the Orthotheriidæ.

I remarked, in the beginning of this article, that I had found some forms characteristic of the Puerco of North America in the beds much more recent than those of the Santacruzian epoch. In fact, I have received from the Paranà, a fragment of a upper maxillary, which shows several tooth sockets and one tooth in place. The latter corresponds to a third premolar. It is impossible to separate this specimen generically from Periptychus (Cope). The tooth resembles perfectly the third upper premolar of *Periptychus rhabdodon* and shows the same grooves or wrinkles in the enamel which distinguishes the North American species. However, the South American species (*Periptychus argentinus* Amegh.) is easily distinguished by its size—almost a third smaller—and by the insertion of the molar teeth which are closer together, forming a continuous series. This specimen was found in the Lower Oligocene or the Upper Eocene in the neighborhood of Paranà.

While I am speaking of the fossils of that region, I must add that the doubts which I had concerning the real nature of Ribodon are now set at rest. The new material at hand shows that *Ribodon limbatus* belongs to the Sirenia, and is one of the family of Halitheriidæ.

III.

I would like, in closing, to reply to the objections that have been made to my classification of the Tertiary beds of the Argentine Republic, and particularly to the assertion of Professor Steinmann, who maintains that the beds I have designated Miocene and Pliocene are only Plistocene (or Quaternary).

I have not the complete work of Professor Steinmann, and therefore will refer only to the extracts that he has published.[1]

I am more and more convinced that the Pampean formation is tertiary, and not quaternary. The Araucanian, of which Professor Steinmann speaks, is entirely distinct from the Pampean formation. The vast difference which exists between the Paranà fauna and that of Monte-Hermoso is easily explained by taking into account the fact that the first is Lower Oligocene or Upper Eocene of the old geologists, while Monte-Hermoso is Upper Miocene. Some day, when the Lower Miocene of Catamarca (an Araucanian bed) is explored, and the mammalian fauna of that formation is satisfactorily known, the great break that is now held to exist between the fauna of the Paranà and that of Monte-Hermoso will largely disappear.

I am astonished that any one can still speak of a glacial epoch and of traces of glacial action in connection with the Pampean, and still more so in regard to the pre-Pampean formations. The Araucanian bed is formed by the accumulations of volcanic detritus. The Pehuelche is of fluviatile origin. Is it necessary to repeat for the hundredth time, that there is not the least vestige of glacial action in the Pampean formation?

---

[1] American Naturalist, 1891, p. 855.

It is impossible to name single fossil species from the Pampean formation which is characteristic of a colder climate than now prevails in the same country. On the contrary, not only does the mammalian fauna indicate a warmer climate than at present, but the fresh water conchological fauna also furnishes similar evidence. The many fossil plants of the Pampean formation are the same that are seen to-day in the province of Buenos-Ayres, or in the northern part of the Argentine Republic—not a single form belonging to a cold climate. I am almost certain that an examination of the marine shells of the same formation would lead to the same result. I am about to make a collection of them to send to M. von Jhering, whom I will request to study them from this point of view.